

SECTION 16441 - SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes service and distribution switchboards rated 600 V and less.

1.3 SUBMITTALS

- A. Product Data: For each type of switchboard, overcurrent protective device, TVSS device, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each switchboard and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of switchboards and overcurrent protective devices.



- d. Utility company's metering provisions with indication of approval by utility company.
 - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
2. Wiring Diagrams: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEMA PB 2.
- C. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver in sections of lengths that can be moved past obstructions in delivery path.
- B. If stored in areas subjected to weather, cover switchboards to provide protection from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside switchboards; install electric heating (250-W per section) to prevent condensation.
- C. Handle switchboards according to NEMA PB 2.1.

1.6 PROJECT CONDITIONS

- A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.



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- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Architect not less than seven days in advance of proposed utility interruptions. Identify extent and duration of utility interruptions.
 2. Indicate method of providing temporary utilities.
 3. Proceed with utility interruptions only after receiving Architect's written authorizations.
- C. Environmental Limitations: Rate equipment for continuous operation under the following, unless otherwise indicated:
1. Ambient Temperature: Not exceeding 104 deg F (40 deg C).
 2. Altitude: Not exceeding 6600 feet (2000 m).

1.7 COORDINATION

- A. Coordinate layout and installation of switchboards and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."

PART 2 - PRODUCT

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:



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1. Eaton Corp.; Cutler-Hammer Products.
 2. General Electric Co.; Electrical Distribution & Control Div.
 3. Siemens Energy & Automation, Inc.
 4. Square D Co.

2.2 MANUFACTURED UNITS

- A. Front-Connected, Front-Accessible Switchboard: Fixed, individually mounted main device, panel-mounted branches, and sections rear aligned.
 1. Main Devices: Fixed, individually mounted.
- B. Nominal System Voltage: 208 Y/120 V.
- C. Main-Bus Continuous: 3000.

2.3 FABRICATION AND FEATURES

- A. Enclosure: Steel: NEMA 250, Type 3R.
- B. Enclosure Finish for Outdoor Units: Factory-applied finish in manufacturer's standard color, including undersurfaces treated with corrosion-resistant undercoating.
- C. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.
- D. Barriers: Between adjacent switchboard sections.
- E. Space Heaters: Factory-installed electric space heaters of sufficient wattage in each vertical section to maintain enclosure temperature above expected dew point.
 1. Space-Heater Control: Thermostats to maintain temperature of each section above expected dew point.



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- 2. Space-Heater Power Source: Transformer factory installed in switchboard.
 - F. Utility Metering Compartment: Fabricated compartment and section complying with utility company's requirements. If separate vertical section is required for utility metering, match and align with basic switchboard.
 - G. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.
 - 1. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
 - 2. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
 - 3. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.
 - H. Buses and Connections: Three phase, four wire, unless otherwise indicated. Include the following features:
 - 1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity with feeder circuit-breaker line connections.
 - 2. Ground Bus: 1/4-by-2-inch (6-by-50-mm) minimum size, drawn-temper copper of 98 percent conductivity, equipped with pressure connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
 - 3. Contact Surfaces of Buses: Silver plated.
 - 4. Main Phase Buses, Neutral Buses, and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
 - 5. Neutral Buses: 100 percent of the ampacity of the phase buses, unless otherwise indicated, equipped with pressure connectors for outgoing circuit neutral cables. Bus extensions for busway feeder neutral bus is braced.
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- I. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

2.4 TVSS DEVICES

- A. IEEE C62.41, integrally mounted, plug-in style, solid-state, parallel-connected, sine-wave tracking suppression and filtering modules.
- B. Minimum single-impulse current rating shall be as follows:
 - 1. Line to Neutral: 100,000 A.
 - 2. Line to Ground: 100,000 A.
 - 3. Neutral to Ground: 50,000 A.
- C. Protection modes shall be as follows:
 - 1. Line to neutral.
 - 2. Line to ground.
 - 3. Neutral to ground.
- D. EMI/RFI Noise Attenuation Using 50-ohm Insertion Loss Test: 55 dB at 100 kHz.
- E. Category C combination wave clamping voltage shall not exceed 600 V, line to neutral and line to ground on 120/208 V systems.
- F. UL 1449 clamping levels shall not exceed 400 V, line to neutral and line to ground on 120/208 V systems.
- G. Withstand Capabilities: 3000 Category C surges with less than 5 percent change in clamping voltage.

2.5 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

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1. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 - B. Enclosed, Insulated-Case Circuit Breaker: Fully rated, encased-power circuit breaker with interrupting capacity rating to meet available fault current.
 1. Fixed circuit-breaker mounting.
 2. Two-step, stored-energy closing.
 3. Microprocessor-based trip units with interchangeable rating plug, LED trip indicators, and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments with I^2t response.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 4. Remote trip indication and control.

2.6 CONTROL POWER

- A. Control Circuits: 120 V, supplied through secondary disconnecting devices from control-power transformer.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.



3.2 EXAMINATION

- A. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Install switchboards and accessories according to NEMA PB 2.1.
- B. Support switchboards on concrete bases, 4-inch (100-mm) nominal thickness.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.
- D. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

3.4 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."
- B. Switchboard Nameplates: Label each switchboard compartment with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.5 CONNECTIONS



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- A. Install equipment grounding connections for switchboards with ground continuity to main electrical ground bus.
 - B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.6 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Testing: After installing switchboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Sections 7.1, 7.5, 7.6, 7.9, 7.10, 7.11, and 7.14 as appropriate. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.7 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

3.8 CLEANING

- A. On completion of installation, inspect interior and exterior of switchboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 16441

